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A Weekly Journal Devoted to Industrial and Engineering Chemistry

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No. 1245

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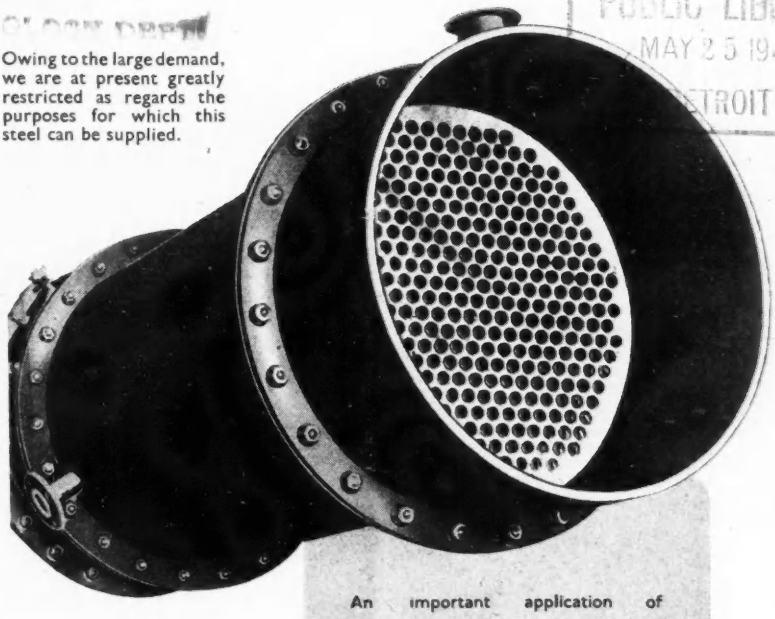

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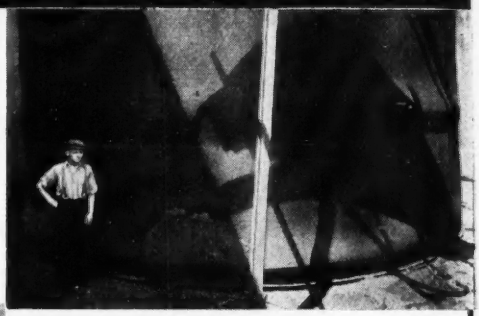

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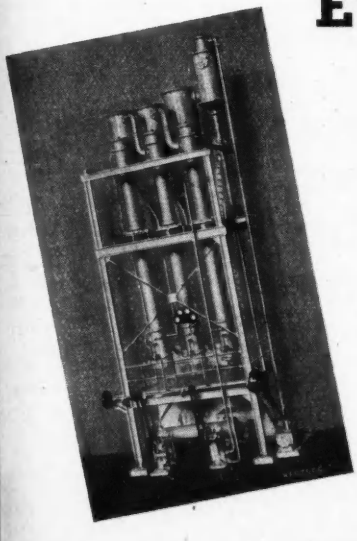

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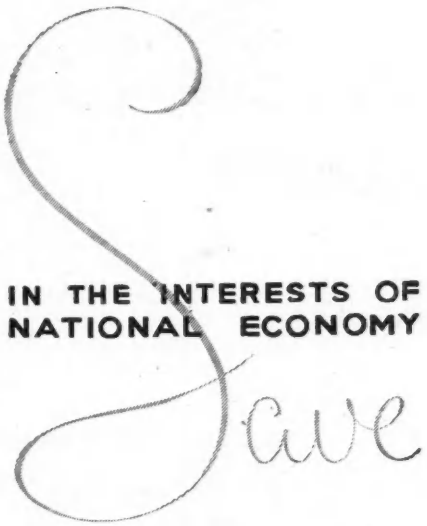

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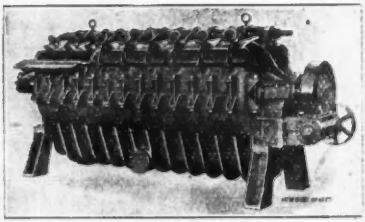

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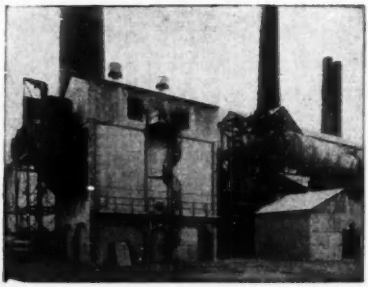

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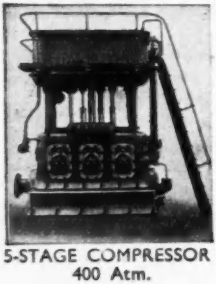

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Science in the East

WHETHER we turn our eyes to the East or to the West we find ourselves confronted with a world in which science plays the predominant part. Science is likely to continue to do so for many generations to come; if our civilisation lasts, it will play its part to the end of time. We have repeatedly called attention in these columns to the part that science is playing in America. We have noted the great development of research in that country, the immense expansion of chemical industry consequent upon that work, and the breath-taking developments that have arisen from the application of science to industry. The time has now come to look in the other direction, to the East. Passing over Germany, so long held up to the British as an example of how to use science, attention was focussed on Russia by Mr. J. G. Crowther when delivering the Trueman Wood Memorial lecture to the Royal Society of Arts. There we meet with an equally vast application of science, though other methods are used. In America the reason for the intensive application of science could perhaps be summed up in two words: "Research Pays." In Russia the reasons why science has been fully exploited are more complex, and will bear careful study. The essential driving force, if Mr. Crowther's view is correct, derives from the important place that science holds in Soviet philosophy. This philosophy is founded on Karl Marx. One of the few things really applicable to this country that Marx wrote was that "England possesses all the necessary conditions for social revolution; what she lacks is revolutionary passion"; which goes to show that East is East and West is West. . . . Karl Marx declared "In the beginning was the world . . .," and since, in his view, material things antedated spiritual things, it is in the material world that we should search for the truths of the Universe. To seek the truths of the material world involves scientific research. How far this is the real reason for the Russian quest for scientific development, we leave our readers to judge, but it is clear that, holding these views, the leaders of the early years of the U.S.S.R. would be predisposed to view science benevolently. Other reasons for the growth of science in Russia adduced by Mr. Crowther were its practical value in peace and war. Unquestionably its military value has been proved up to the hilt.

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News from Russia—reliable news that is—has always been scanty, but it seems certain that the material value of science has been fully proved there.

Whatever may have been the reasons for developing science, there can be no doubt that developments have been on a great scale. The Russian leaders recognised from the beginning that to put science into practice it is necessary to have an adequate supply of trained scientific workers. Their first step was to set about training these workers. A comparatively small band of scientists of high grade was formed into schools ("Institutes") and to them were sent students of promise for a five-year course. Physics seemed to have been the principal preoccupation of the Russians in the early days; in that the East has differed from the West, for here physics is still somewhat strangely regarded as a minor science pursued by the few. Electricity was the first of the major scientific arts to be widely applied in Russia. Russia was, of course, helped largely by other nations in all this—a fact that Mr. Crowther ignored. Still, to the credit of the Russian leaders, they went the right way about the business, built up a number of schools of science, and trained hundreds, possibly thousands, of men and women in scientific methods. Finally, by 1928, sufficient had been trained to play the scientist's part in the first five-year plan. Russian science then was probably, in the main, technology. Although pure science was not neglected, applied science was the chief objective.

The result of the work of the physicists, engineers, electricians, geologists, biochemists, and the rest has been to survey the people and the land of Russia, to show that it is a country of immense wealth and potential power, and to indicate that it can be made virtually self-supporting by proper internal development. Institutes have been opened in all parts of the U.S.S.R. to serve as centres of training and research, and each caters specifically for the industries in its neighbourhood. In that the Russian Institutes are almost exactly similar, or so it appears to us, to our provincial Universities. Thus individual institutes specialise (for example) in metallurgy, electricity and its applications, coal by-products, the separation of gases at low temperatures, and so forth. Where the U.S.S.R. appears to have a bigger conception of science than we is in the greater extent to which these facilities are developed, in the wider encouragement given to scientific men, and in the provision of special "Institutes" for particular men of genius. Probably the research professorships of the Royal Society are the nearest thing to these, but whereas we appoint a few outstanding men to professorships which enable them to give all their time to research, the U.S.S.R. builds a whole college and staffs it so that a particular man may have the facilities for developing a special flair for research in a particular field. In other words, when they find a good man they let him have his head, free from monetary worries and at the expense of the State.

Mr. Crowther described an impressive list of discoveries made by Soviet citizens in the past 20 years; whether these are greater, less, or equal to those of other similar nations we do not know. What is certain is that the U.S.S.R. has developed scientific work as an element of statecraft; it is an integral part of the State economy, and more than that, the economy of the State is built round its scientific and technical men and women. The scientists have great prestige, they are well paid, and they are given the opportunity of earning large prizes for discoveries of importance. Mr. Crowther mentioned individual prizes of the order of £10,000, and indicated that the 1942 list of awards ran to about £500,000.

The extent to which America and Russia are encouraging science should make us think of our own position. Sir Stafford Cripps, from the chair, asked roundly whether we made enough use of our technical men. In his view they are fully equal to those of other nations, and this is, of course, a proven fact. Do we encourage them sufficiently, and do we give them the opportunities that they should have, and indeed must have if our technical supremacy is to be maintained? It is cheering to hear a Minister of the Crown state boldly that in his view "our future will depend upon how we handle science and research," and to hear from him that the State should play a larger part in providing resources for research, development, and training; but the free choice of methods and subjects must be allowed to stand.

NOTES AND COMMENTS

Imperial Institute's Jubilee

ON May 10 the Imperial Institute at South Kensington celebrates the 50th anniversary of its opening by Queen Victoria, who six years previously had laid the foundation stone. This corner stone, as was appropriate to the Imperial nature and objects of the institute, was a huge block of granite from Cape Colony standing on a pedestal of Indian bricks. The management, first vested in the Board of Trade, was transferred in 1925 to the Department of Overseas Trade. Aptly described as "the Empire under one roof," the Institute exists to promote the utilisation of Empire products and to make better known the life, resources, and industries of the various countries which comprise the British Empire. Its ever popular exhibition galleries and its extra popular cinema have been of great propaganda and instructive value, both in arousing and in satisfying our curiosity about the British Commonwealth of Nations, of which most of us are still all too ignorant. In addition to this valuable educational function, the Institute maintains a technical intelligence bureau which has been of service to Government departments and commercial firms alike. The staff includes experts who can answer inquiries on a wide range of subjects of which chemical technology, mining engineering, mineralogy, and tropical agriculture are but a few. When necessary, inquiries can be passed to the well-equipped laboratories where raw materials can be tested and analysed. The value of this advisory service is increased by the fact that the Institute has fifteen consultative committees of authoritative professional and business men to whom it can refer inquiries when desirable, and further help is afforded by the Institute's numerous trade contacts.

War-Time Interests

MANY examples of its usefulness in war time can be quoted. For instance, the war brought a special demand for activated charcoal for gas masks and for industry; the Institute has been able to answer inquiries as to suitable raw material for these purposes, both from manufacturers in Britain and from Empire sources of supply. Another instance of the two-track way in which industry is put in touch with the Empire and the Empire with industry is provided by another useful product, tung oil. For many years past the Institute has worked to develop the production of tung oil in suitable Empire countries, examining countless samples of fruits and oil which experimental cultivation in different parts of the world had yielded. The necessary information was ready to hand, documented to the last practical detail and immediately applicable the moment we were cut off from our sources of supply at a time when the aircraft industry was demanding tung oil in increasing quantities. Exploitation of mineral resources—such as bauxite from the Gold Coast, tantalite from Uganda, mica from Burma—is another direction in which the Institute has helped the war effort. The Institute's staff has carried out these and other tasks with great competence: their monographs on minerals, for instance, have been models of documentation. Full development of the resources of the Empire must inevitably be an important post-war project, and to this end the Imperial Institute has much to contribute. Let us hope that in another fifty years' time it will be as well known to industrialists as it is to London's school-children, the keenest users of the Institute in the whole Empire.

Moulds on War Production

IN the last war the biochemical activities of moulds and other micro-organisms seemed to offer such great prospects that one German chemist was prompted in the middle of a lecture to a scientific society to flourish an evening newspaper at his audience and make the prediction that the time would come when it would be possible to convert those pages of newsprint into the following morning's breakfast. There were some grounds for his optimistic exaggeration. Germany was producing huge quantities of glycerol by fermentation, and the Allies were so far puzzled that it became possible to gull the British public into the belief that the Germans were distilling corpses from the battlefield! By means of moulds inorganic salts were being converted into protein, a discovery which opened up prospects of farming

foodstuffs in the laboratory. By the end of the war the use of moulds and bacteria in the chemical industry was in full swing. But the promise of those last war years did not fully materialise, so that in 1937 we find Professor H. Raistrick deploring the fact that, compared with the time and energy lavished on studying the biochemical effects of yeast, so little attention was paid to other fungi. In this field the work done since this war started has compensated for any lack of balance before 1939. Much progress has been made with the chemical agents like penicillin which seem to ruin the digestions of the most resistant bacteria and so prevent them from multiplying inside the human body. Fourteen years ago penicillin was no more than a lucky, unexplained phenomenon in a Petri dish. To-day, the blue-green mould which produces it can boast of being the only mould with a Government committee all to itself, including not only five professors, but representatives of two ministries. A distant cousin, *Aspergillus niger*, the common black mould, is working overtime in many different countries, turning out thousands of tons of citric acid so that no one shall miss Nature's "salts of lemon." Food yeast is being used to supplement the rations of pigs, poultry, and other livestock, while a more refined variety, developed at the Chemical Research Laboratory at Teddington, will soon be yielding protein and vitamin B_1 on a large scale for human beings. We can surely agree with Professor Raistrick's remark that the study of the biochemical changes, almost bewildering in their diversity, which can be brought about by moulds, is now a rapidly developing branch of biochemistry.

German "Penicillin"

BRITAIN is well established in this field, but we may be sure that Germany is not neglecting this branch of biochemistry. The bacteriostatic agents obtained from moulds, for instance, are being carefully investigated on the Continent. In a recent lecture to the Society for Medicinal and Natural Sciences at Jena, Professor Kuhn described the biological effects of boric acid noted in experiments carried out at his institute at Heidelberg. He found that three types of saccharomyces growing on bread and jam, when treated with boric acid, produce a brilliant yellow dye which he calls "borocitrin." These three yeasts also yield "penicillin," and a high-molecular protein material, called "notatin." (It is not clear whether these chemical agents are identical with our penicillin and notatin). The astonishing effect of the German "notatin" is said to be similar to that of the sulphonamides, but it is effective at a dilution 5000 times greater. The high anti-bacterial effect may be due to the fact that this substance acts as a ferment in the cell, releasing hydrogen peroxide; it would thus form bacteriostatic agents from substances available in the organism.

Smashing German Industry

NO doubt in 1939 this country was unprepared for war, but when we did start to prepare, we envisaged a long-drawn-out struggle, and sited our factories accordingly. Germany, on the other hand, reckoned on a lightning victory, and kept her munition works concentrated in the places where they were most convenient, and from which their products could be most expeditiously conveyed to the all-conquering armies. Now that the *blitzkrieg* policy has proved illusory, the day of reckoning has come, and the German industrial areas are suffering accordingly. The Ministry of Economic Warfare has issued a statement and a map explaining the policy which actuates the bombing raids on German industry. Despite all efforts to make us believe the contrary, the German heavy industries are still concentrated in their traditional sites, though some of the lighter industries have doubtless left the Ruhr and the Rhineland for safer areas farther East, and the heavy raids on the Ruhr and the Frankfurt-Mannheim-Stuttgart area are having a seriously detrimental effect on German munition production. The heavy chemical industries, including the explosives and the oil industries, are concentrated around Mannheim and Düsseldorf, in the district between Leipzig and Magdeburg, and to a lesser degree around Berlin, Hamburg, Hanover, and Stettin. The destruction or damage which over 2000 factories have suffered, according to Sir Archibald Sinclair, cannot fail to have produced very satisfactory results in lessening the output of the German war plants.

Hardened Edible Oils, II

Hydrogenation Methods

by H. R. MITCHELL, M.I.Chem.E.

(*Continued from* THE CHEMICAL AGE, *May* 1, 1943, *page* 475)

THE general practice of hydrogenating edible oils has not changed much during recent years and consists of:

(a) The preparation of the nickel salt and its reduction to metallic nickel;

(b) The addition of the finely divided catalyst to the oil, and the mechanical agitation of both with hydrogen at about 180-220° C. for the necessary time;

(c) The separation of the oil and catalyst on completion of hardening.

The process can be conducted by using a nickel catalyst with or without an inert support. In the first case, the catalyst is, so to speak, attached to a support or carrier, generally kieselguhr. In the second case, the catalyst is free and suspended in the oil, typically represented by the nickel formate method. This catalyst is produced by reducing nickel formate at a temperature varying between 200° and 250° C. and the reaction is represented by the equation:

$$(HCOO)_2Ni.2H_2O = Ni + H_2 + 2CO_2 + 2H_2O$$

The "wet" process, as it is termed, has largely superseded the supported or "dry" method which needed very complicated and expensive machinery, consisting of solution tanks, a precipitation tank, a filter press and pump, drying oven, gear-driven reducing vessel, oil-catalyst reservoir and grinder for reducing the powder. This method of catalyst preparation is very slow and costly; moreover, high temperatures are needed during the reduction period with consequent deleterious effect on the uniformity and activity of the catalyst.

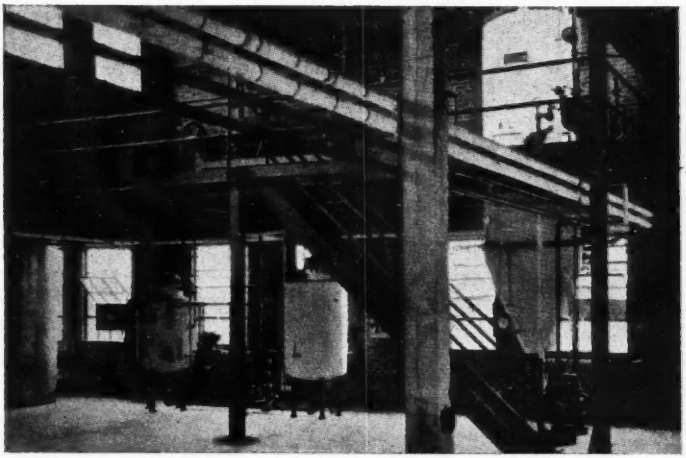


Fig. 3. Wurster and Sanger hydrogenation plant, showing reducer, mixing tank, filter press, and converter.

In the formate process the nickel salts are reduced in oil of the same nature as that which is to be hardened. The Wurster-Sanger hydrogenation plant (Fig. 3) has been very suitably developed on these lines. The nickel formate is introduced into a catalyst reducer with the requisite quantity of oil and is kept in suspension by means of mechanical agitation. A small quantity of hydrogen gas is passed through the oil-catalyst mixture, which, being allowed to blow off to atmosphere, carries with it the hydrogen, carbon dioxide, and moisture formed during the reaction. In this particular process, reduction is carried on at a specified temperature under accurate automatic control, for a period of 2 to 4 hours, until a simple examination of the

catalyst shows that reduction is complete. Practical experience has shown that by this method a catalyst is produced having great activity, high selectivity, and a strong resistance to catalyst poisons. Moreover, the accuracy of control and the comparatively low temperature of reduction produces a catalyst of extremely high uniformity, the use of which results in the subsequent production of hardened fat of uniform quality.

Although, as has already been stated, hundreds of patents exist, many of which deal with plant and methods of bringing the oil, hydrogen, and catalyst into intimate contact during the actual hardening operation—some of them very complicated and ingenious in character—the plant now in general use consists of a cylindrical vessel—converter or catalyser—fitted with heating coils and, since the reaction is exothermic, with some form of cooling, together with an agitation and/or circulation system and the necessary pipes and valves for oil, hydrogen, vacuum, etc. (Figs. 4, 5, 6). A well-designed plant will include a catalyst mixing tank which admits the mixing of the required quantity of catalyst with some of the oil charge outside the actual converter. This oil-catalyst mixture is then pumped to the converter wherein is the balance of the charge. A circulation system keeps the oil and catalyst mixed, while the heating system raises the charge to reaction temperature. Meanwhile the vacuum system removes air and moisture. Hydrogen is then admitted and the gas pressure is brought up to the required operating pressure. A cooling system controls the temperature of the aforementioned exothermic reaction as it commences.

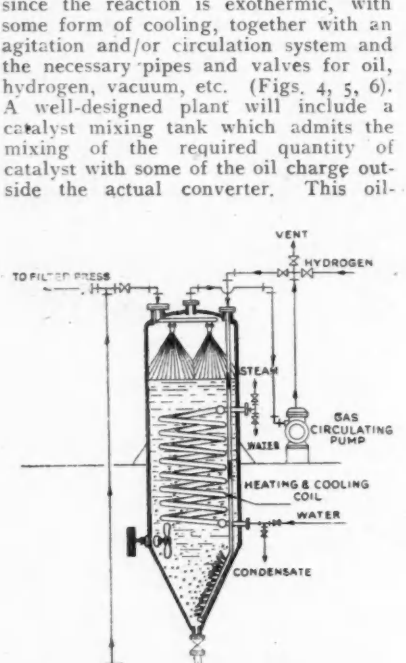


Fig. 4.—Hydrogenator with internal heating and cooling coil, oil and catalyst circulating pump, gas circulating pump, and propeller-type mechanical agitator.

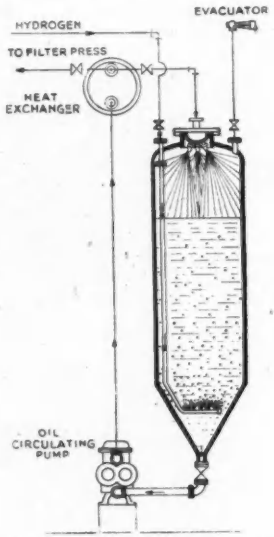


Fig. 5.—Hydrogenator with external heat exchanger and oil and catalyst circulating pump.

Agitation and circulation are constant and controlled throughout the operation. The time of operation, including the period of heating and cooling down the oil, will vary, according to the particular method adopted and the hardness of the product required, from 1 to 8 hours.

When the simple tests designed to control the degree of hydrogenation indicate that the desired hardness has been attained, the hydrogen supply is stopped and the charge is cooled to such a temperature as will allow it to be pumped through a filter press without detriment to colour and quality. This temperature will necessarily depend on the degree of hardness of the finished product required,

but in general will not be higher than 70° C. The clear filtered oil is run to the hardened-oil tank, from which it is taken to the deodoriser as required. The catalyst remaining on the plates of the filter press is afterwards removed and dropped into the catalyst mixing tank, where, according to the system adopted, it is either mixed with a fresh batch of oil alone or with a small addition of fresh catalyst from the catalyst reducer, for the next batch of oil to be hardened.

After-Treatment of Hydrogenated Oil

As mentioned previously, in the case of hardened oils for edible purposes, deodorisation comes after hydrogenation. The clear, filtered, hardened oil is taken from the hardened-oil tank to the deodoriser; generally this is accomplished by pulling a vacuum on the deodoriser and sucking the oil thereto.

Deodorisation is the elimination of objectionable odours and flavours inherent in oils and fats, and inasmuch as hydrogenation gives an added characteristic odour, known as hydrogenation flavour, to the oil, this operation is the last step with all hardened fats which are to be used either alone or mixed with other materials for edible purposes. Deodorisation may be justly described as a highly specialised type of steam distillation under vacuum. Its object is to remove those infinitesmally small quantities of volatile bodies characteristic of the variety of crude oils now used for edible purposes. These may belong to either a terpene, ketone, alcohol, or aldehyde group, as in the majority of vegetable oils, or may consist of sulphur compounds in oils like rape, toria, and mustard, or of nitrogenous compounds as in fish oils. The removal of these bodies is effected by heating the oil to temperatures (according to the oil and the actual method used) between 175° and 220° C. under a vacuum of 28 to 29.7 inches, passing at the same time either high-pressure saturated steam or superheated steam, by means of some form of spray, through the oil.

Most of the developments during recent years have been directed towards increasing the area of contact of oil and steam, and to working at the lowest possible pressure. Theoretically the temperature should be the highest it is possible to use without decomposing the oil; and the vacuum as near as possible to a perfect vacuum. Without actually reaching this point of perfection, deodorisation systems are available which in their

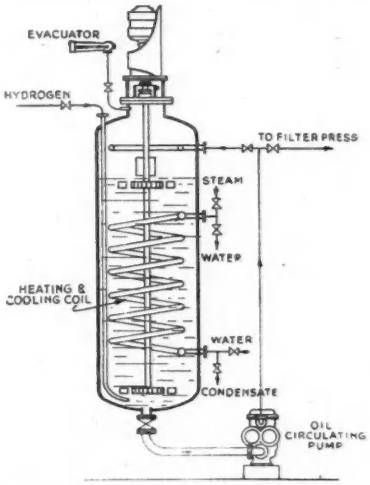


Fig. 6.—Hydrogenator with internal heating and cooling coil, oil and catalyst circulating pump, and turbine-type mechanical agitator.

operation approach very closely to these ideal conditions. It is nevertheless true to say that industrially satisfactory results can be achieved without the elaborate devices required by some of these systems, provided that absolute exclusion of air is achieved during the operation and until the oil is cooled.

For large installations, continuous deodorising plants are now available. One advantage of continuous working is that it permits the use of heat exchangers, resulting in greater heat economy than is possible in batch operation. The type of process and equipment best suited to a particular refinery can be very simply determined by the oil technologist, with a knowledge of the oil to be deodorised, the output required, and particulars of steam, water, and power available.

When satisfactory deodorisation is obtained, generally in about 6 to 8 hours, the oil is passed to a cooler, which may or may not be fitted with some form of agitation, and still under vacuum; there, by means of water either in coils or jacket, the temperature is lowered to a

point a few degrees above melting point. Generally, as a final precaution and to ensure that the finished product shall have a clean, bright appearance, the deodorised oil is filtered again before passing to low-temperature storage or, as usually happens, to the tempering plant where it is chilled and plasticised for shortening purposes, or to the churn where it is mixed with oils and other materials for the production of margarine.

Catalyst Recovery

In ordinary circumstances, for example in hydrogenating vegetable oils for shortening or compound purposes, catalyst consumption is so low that recovery and reactivation by the oil refinery is not at all economic. At this stage the catalyst is mixed with oil and all the various impurities, filter aids, etc., inherent in the process, and generally it is considered more practical to dispose of the spent catalyst to producers of nickel salts. With moderately large installations, however, a small and easily operated catalyst recovery plant can be installed. The first stage is one of solvent extraction which removes the entrained oil, the solvent being afterwards recovered by distillation for re-use and the entrained fat used or otherwise disposed of. Then follows the solution of the nickel by means of acid, its conversion and precipitation to carbonate, and finally its reduction to nickel formate again.

As mentioned at the beginning of this article, it is not intended to enter into the intricacies of the scientific problems involved in the process of hydrogenation, because so much has already been written on this subject. In view, however, of its importance from a practical and commercial point of view, a brief consideration of its main points should be of interest to the producer of hardened edible oils.

Changes During Hydrogenation

The chief physical and chemical changes in fats which occur during hydrogenation are usually associated with increase of melting point and decrease of iodine value; nevertheless hydrogenated oils having the same iodine value and made from the same oil may differ from one another in three ways: (a) the composition of the mixed glycerides; (b) the degree of selectivity; (c) the proportion of *iso*-oleic acid formed. For the purpose of this article (a) may be ignored.

It has already been mentioned that liquid oils consist mainly of oleine which, when combined or "saturated" with hydrogen, is transformed to stearine. Liquid oils, however, are composed of more than one class of these "unsaturated" glycerides, varying in the degree of unsaturation. The three most common to liquid oils are those of oleic, linoleic, and linolenic acids, each one being more unsaturated than the preceding. These unsaturated glycerides are of interest to the manufacturer of edible hardened oils inasmuch as the stability or keeping properties of the finished product depend upon the degree to which these unsaturated glycerides have been eliminated. Long before hardened oils became so important an item of daily food, technologists discovered that in the process of hydrogenating fatty oils "selectivity" of hydrogenation occurs, that is, the more unsaturated linolenic acid is first hydrogenated, with the formation of the less unsaturated linoleic acid, and so down to the oleic stage, before any substantial amount of stearic acid is formed. As if to make the problem more difficult, however, the formation of a solid isomer of oleic acid, now generally accepted under the name of *iso*-oleic acid, linked itself with the hydrogenation of fatty oils.

Iso-Oleic Acid

Simultaneously with the development of oil-hardening, much research has been devoted to this formation of *iso*-oleic acid during hydrogenation. Apart from the purely chemical problems of discovering satisfactory methods of determining its presence in hardening fats, and the more complicated questions involved as to its exact composition, the advantages and disadvantages of its presence from the point of view of its edibility in food products, and its value or otherwise in hardened fats used only for technical purposes have been the subject of a great deal of discussion. Naturally, therefore, the determination of the conditions of hydrogenation favouring its formation or depression have been examined at great length. Experience has shown that increases in the amount of catalyst and temperatures up to 200° C. favour selectivity; while increase of

pressure, reduction of temperature below 180° C., agitation of the oil with the catalyst, and too great a concentration of the catalyst, reduce selectivity. High temperature, however, favours the formation of *iso*-oleic acid as does also long operational time.

The Effect of Varied Conditions

So synonymous with oil hardening had *iso*-oleic acid become that only some fifteen years ago it was stated that the actual hardening of oils to solid fats was due exclusively to the formation of *iso*-oleic acid. Even though a conclusion such as this may be considered too rigid, very little doubt exists that the high melting-points of fats produced by some methods are due largely to the presence of this isomer of oleic acid. It has been shown, industrially and experimentally, however, that by varying the conditions and technique of hydrogenation, solid fats can be produced which do not contain sufficient *iso*-oleic acid to account for the high melting-points of these fats. It will be appreciated, therefore, that the extent to which this isomerism occurs is as dependent on the nature of the catalyst and method of hydrogenation as it is on the conditions of the reaction itself.

An examination of many hundreds of analyses of hardened oils has indicated the presence of *iso*-oleic acid to the extent of as much as 30 per cent. in many samples hardened to melting-points of 38°-40° C., but during recent years, particularly in America where considerably over half a million tons of vegetable shortening are consumed annually, manufacturers have encouraged a depression of the *iso*-oleic glyceride in hardened fats. The aim of every manufacturer of vegetable shortening or lard compound, however, is to produce an edible hardened oil having a smooth, homogeneous, lard-like consistency; without odour; with a bland pleasing flavour; and able to withstand a wide range of temperature during transit and storage without deterioration in quality.

Catalysts Must be Pure

In the course of an address to the Institution of Chemical Engineers, two or three years ago, the President said "Many of the reactions of to-day depend on catalysis: catalytic reagents are a branch of specialised knowledge by itself and the guiding signposts are *purity*, fine division, and ease of reactivation." This confirms a remarkable conclusion by Faraday, who more than 100 years ago, did much to weld the relatively unscientific knowledge of catalysis in those days into something of an art. His criterion of a catalyst was simple. "It must be clean and pure." To ensure this, control of the refining; of the preparation of the catalyst; and of the operational conditions of hydrogenation concerning catalyst, hydrogen, temperature and pressure, is of supreme importance.

The object of this article will have been achieved, if it has brought about a realisation in the mind of the reader that these very essential features can be attained by :—

(1) The installation of carefully designed and soundly constructed plant which will enable the operators to carry out the various stages of the process with ease, precision, and economy; and (2) the selection of a hydrogenation process which will produce and incorporate the use of a catalyst possessing the highest possible degree of activity and selectivity.

WATER POWER AND CANADIAN METALLURGY

In every branch of the Canadian mineral industries, from the preliminary drilling to the final refinement of the product, vast amounts of hydro-electric power are used. In many cases it is the large scale of the mining and processing which alone makes the difference beween profit and loss, and this scale has only become possible because of abundant supplies of low-priced electricity derived from water power. An example of a metallurgical industry entirely dependent upon hydro-electric power is provided by Canada's aluminium production. The largest aluminium plant in the whole world is situated in Canada and the country's total production provides 40 per cent. of the aluminium used by the United Nations. Even in areas where there is plenty of coal hydro-electricity is still the cheapest form of power available, and, indeed, many coal mines have abandoned the use of coal to produce power at the pithead because of the low cost and flexibility of the alternative source of energy. The Canadian Department of Mines estimates that the available water power totals 25,439,400 h.p. under conditions of ordinary minimum flow, while for six months of the year a total of 39,511,700 h.p. is reached.

Fireworks in War Time

Canada Makes Flares and Verey Lights

IN peace time the fireworks industry is a specialised branch of applied chemistry wholly unfamiliar to most people because the details of its manufacturing operations have been closely guarded secrets for centuries. Since the outbreak of war its job has been to supply signal flares, smoke generators, and other types of pyrotechnics for all three fighting services, and an interesting account of the way the transformed industry is now working in Canada is given in *Canadian Chemistry and Process Industries* (February, 1943, p. 58).

Essential Chemicals

The fundamental principles are the same whether fireworks are required to illuminate a bomber target or to entertain a pleasure-seeking crowd of spectators. To produce flares with a high intensity of illumination, oxidising agents such as potassium perchlorate, potassium nitrate, and sodium nitrate are used to burn up a powdered combustible —either magnesium, aluminium, or antimony. Coloured signal flares and Verey lights are produced in the same way as Bengal lights, great favourites on Guy Fawkes night, by incorporating various chemical substances such as strontium nitrate, oxalate, or carbonate for red flares; barium nitrate, chlorate, or chloride for green flares; sodium nitrate or oxalate and cryolite for yellow flares, and copper and/or arsenic salts (Paris green) for blue flares. A very satisfactory white signal flare results from either powdered aluminium or antimony mixed with potassium nitrate, just a little barium nitrate being added to provide a purifying effect. Fuses and other slow-burning devices are built up around a mild oxidising agent and an easily combustible substance, *e.g.*, a mixture of lactose sugar and sodium nitrate, which gives a slow, even heat and is used in smoke and gas generators.

Ignition Devices

One of the most important features of a pyrotechnic from a military point of view is its ignition device—it must be sure, quick, and convenient. The present accepted practice is to incorporate into each finished article an igniting system working on the principle of enabling the fire to proceed from a very easily fired substance, such as "match compo," to progressively less inflammable booster substances, until it reaches and sets off the final material which is present in quantity. Thus, when a phosphorus-coated stick is drawn across the " match compo," a spark is generated which ignites the " compo " and sets off a silicon preparation, which in turn fires the gunpowder, the flare, or the generator. Fuses or other delaying devices may be inserted at various places in the chain to control or regulate the reaction, according to the designed applications of the product.

Counterpart of the peace-time Roman candle is the marine distress signal flare, which is invaluable to airmen who have been forced down at sea and are adrift in a rubber dinghy. It consists of a large central candle inserted between several short 6-in. flares. The short flares burn with a steady red flame which is visible for a considerable distance, while the central cylinder contains 13 stars which are shot at intervals high into the sky, where they burn with a high intensity. The candle lasts for about a minute, and as its base is wrapped in asbestos paper it can be held in the hand during the eruption. Parachute flares depend upon magnesium powder mixed with an oxidising agent and a binding substance. For the Army a three-inch signal flare is made which can be fired from a mortar. It has a fuse which is set to ignite at a certain height, when the charge burns for 10-12 seconds with a white light visible even in daylight for a distance of over 20 miles.

Non-Spark Equipment

Safety precautions are important in the manufacture of these pyrotechnics. In the making of parachute flares, for instance, the magnesium powder, oxidising agent, and binder are mixed in small isolated buildings with reinforced concrete walls which provide only enough working space for two men at a time. The actual operations of mixing and pressing are performed behind a concrete wall, equipped with a corner mirror arranged so that work can be viewed and performed in comparative safety. All equipment has to be constructed of non-sparking material, and to this end the mixing drums, bag mixers, and ball mills used are made of non-ferrous materials such as brass, copper, and bronze.

Peace-time production facilities of Canada's major fireworks plant have been extended manyfold since the start of the war, and war materials, indispensable to the proper functioning of the three armed services, are being turned out in ever increasing quantities. As a result, Canada is not only supplying her own needs, but is also sending important supplies to Australia and New Zealand and considerable quantities to England and Russia.

Chemical Warfare on Tropical Diseases

Drugs which Protect Our Soldiers' Lives

THE importance of chemical compounds in maintaining the health of our troops in tropical areas is well brought out in the recently published "Memoranda on Medical Diseases in Tropical and Sub-tropical Areas" (H.M.S.O., 3s. 6d.), a handbook for Army medical officers. For scurvy and beri-beri the cures recommended in the book are respectively pure vitamin C and vitamin B_1, while in the treatment of pellagra it is stated that nicotinic acid, in addition to vitamins B_1 and B_2, is of the greatest value. The sulphonamide drugs are of importance for a large number of diseases produced by infective organisms, both bacterial and protozoan. Cerebro-spinal meningitis (spotted fever) is best treated with sulphadiazine, the most suitable and least toxic of the sulphonamide group, while sulphathiazole is considered good, its disadvantage being that it is not always available at present. The most effective drug for curing amœbic dysentery is emetine hydrochloride, but the proprietary products, Stovarsol, Carbasone, and Yatren are also considered valuable. The treatment of bacillary dysentery, it is recognised, has been revolutionised by the introduction of sulphaguanidine, a feeling of well-being being induced in the patient within 24 to 48 hours after the first dose, and even in chronic cases where this drug is not given until 20 days after contracting the disease, 75 per cent. of the patients recover and are completely healed.

Substitute for Quinine

It is a challenge to chemists that an ideal treatment for malaria has not yet been found and that for cholera most drugs are of little or no use. Quinine is still the sheet anchor for minimising the effects of malaria, but the new synthetic preparations such as Mepacrine and Pamaquin are valuable therapeutic agents if used with due regard to their limitations. Mepacrine, which has much the same selective action on the malarial parasite, can be used as a substitute for quinine. Belonging to the acridine series it was first synthesised by German chemists and marketed under the name of Atebrin, of which Mepacrine is the English equivalent. In the U.S.A. the original name Atebrin is still used. It is available in two forms, as the hydrochloride and the methane-sulphonate (the Atebrin musonate of Bayer). Its advantages over quinine are that it is not unpleasant to take (an important consideration in the Army), it is effective in tablet form which makes administration easy, it produces no "allergic" reaction, and it passes out of the body more slowly than quinine, therefore retaining its therapeutic action for a longer time after the cessation of treatment. Pamaquin is a quinoline derivative first synthesised by the German chemists of Messrs. Bayer, by whom it was originally marketed under the name of Plasmoquine, a title that is still used in America. It is not an alternative for quinine and cannot be given during an acute attack of malaria; it is effective, however, if administered after a short course of quinine or mepacrine.

Killing Disease-Carriers

Leishmaniasis is one of the classic diseases in which use of a chemotherapeutic agent was early found to be effective. To-day, the most useful drugs, containing pentavalent antimony, are Neostibosan, Stibosan, urea stibamine, stibamine glucoside (Neostam), etc. In the early stages of sleeping sickness complex urea compounds—Germanin (its British name is Suramin), Moranyl, and British Antrypol (B.D.H.) are valuable chemotherapeutics, while recent work suggests that guanidine compounds, especially Synthalin, may be useful in cases that are resistant to arsenic. The diamidines are also favourably reported on. Serum-injection is the only way of combating typhoid once the disease occurs, but small daily doses of sulphapyridine are found to be useful when coupled with serum-injection.

Many casualties were caused in the last war by insect-borne diseases. One way of controlling these diseases is to prevent insect infestation of troops and their matériel, an effective means of destroying the insect's "lines of communication." For many years the insecticides used against lice, which carry typhus, relapsing fever and trench fever, have been a mixture of naphthalene-creosote-iodoform (N.C.I. powder), cresol, naphthalene, eucalyptus oil, or oil of turpentine (for body lice), and a mixture of kerosene, arachis oil, tar oil, and oil of lemon grass for head lice. It is interesting to note that for head lice the Ministry of Health has recently recommended the use of a hair-oil containing Lethane 384 "special," a preparation which contains *N*-butyl carbitol thiocyanate, β-thiocyanoethyl laurate and refined paraffin in the ratio of 12.5, 37.5 and 50 per cent. This hair-oil, devised by Dr. Busvine and Professor P. A. Buxton (*B.M.J.*, April 11, 1942, p. 464), will doubtless prove useful to Army medical officers. Lethane has also proved effective in London's air-rad shelters.

German Research in Wood Chemistry

New Sources of Cellulose

AN interesting account of recent German work in the field of wood chemistry is given in *Chemical and Metallurgical Engineering* (1943, *50*, 2, p. 196). The article states that two new synthetic fibre research centres have been opened at the Institutes of Technology of Breslau and Munich. The former is sponsored by the Phrix Werke A.G., an important synthetic fibre concern, and the latter, under the direction of Dr. H. Erbring, has the backing of the "Süddeutsche Zellwolle A.G., of Kelheim on the Danube. Among the problems occupying the attention of both institutes is the improvement of processes and equipment needed in order to free some of the three million workers now employed on production and distribution of textiles in Germany for other jobs more directly related to the war effort. Attempts are being made to shift the raw material basis from slow growing timber to annual and biennial plants and so use cellulose sources hitherto wasted, thereby freeing wood for more "valuable" purposes. At present the German synthetic fibre industry takes 1 million tons of wood to obtain some 400,000 tons of cellulose. The paper industry being an even larger user of cellulose, this figure represents only a small part of the total cellulose requirement of the country.

The plants now being used experimentally for this purpose include esparto grass, flax and hemp waste, broom, hop vines, potato tops, corn stalks, grape, rye and wheat straw, sunflowers, and reeds. The use of reeds is being investigated carefully by the Ager Cellulose G.m.b.H. in Vienna and the Süddeutsche Zellwolle at Kelheim. It is estimated that whereas the yield in synthetic fibres averages one ton per year per hectare of forest, reeds of the type of the Danubian *Arundo donax* produce 9 tons per hectare. About 40 tons of cellulose can be obtained from 100 tons of reed, and it is calculated that if one-quarter of the reeds in the Danube delta were harvested and processed, about 475,000 tons of cellulose could theoretically be obtained as against the present yearly production of 40-50,000 tons of cellulose from the Rumanian delta area. The yield from the common reed, *Phragmites communis*, is lower than from the Danubian *Arundo*.

Food Yeast from Wood

In theory, potato tops could yield the Reich 300,000 tons of cellulose a year, but collection, cleaning, and cellulose extraction still present difficult problems, and current processes are still far from being economic. For instance, the Vereinigte Strohstoff Fabriken, of Drtsden-Coswig, shows a consistent operating loss to the tune of a million RM. a year.

Another problem now being investigated is that of obtaining types of cellulose best suited for making cell wool. Since the war began increasing use has been made of "pre-hydrolysis" and by treating the raw material with weak acid, chiefly hydrochloric, with or without pressure, a better grade of cellulose has been obtained. Experiments carried out by the Thuringsche Zellwolle A.G., Schwarza, with "chlorsulphate" pre-hydrolysis have succeeded in raising the α-cellulose content from 90 to 95-97 per cent. and in facilitating removal of pentosans. Experiments are being made to find new uses for the hemicelluloses which are removed in the preparatory hydrolysis in order to prevent the fibre from deteriorating. These hemicelluloses contain 3-4 per cent. sugars which by fermentation with the yeast *Torula utilis* (in the presence of phosphate and ammonium salts), can be transformed into a yeast rich in vitamin B_1 and B_2. This food yeast, it is claimed, is fit for animal and even human consumption. The Phrix Company reports that in one of the larger cell-wool plants, 50-60 tons of yeast (50 per cent. of which is protein) can be produced a day. With the present production of chemical fibres in Germany, it is therefore estimated that 100,000 tons of pure protein could be made from this source, which has previously been neglected.

Non-Inflammable Textiles

As a big user of heavy chemicals, including sulphuric acid, caustic soda, and carbon bisulphide, the German cell-wool industry is paying great attention to the improvement of processes for recovering the chemicals used.

The problem of reducing inflammability of cell-wools and rayons so that they can be used for electrical insulation, etc., is claimed to have been solved by a new process using tungstates. Sodium tungstate solution is applied first, and then a dilute tin chloride solution to give tin tungstate impregnation. Aluminium and zinc tungstates have also been tried, as well as mixtures of tungstates and phosphates. Direct production of non-inflammable rayon by the acetate process has been carried out by adding to the spinning solution small amounts of ortho-tungstates and nickel borate, together with $Mg-NH_4-$orthophosphate, $Ca-NH_4-$dimetaphosphate, and $Zn-NH_4-$orthophosphate.

Low-Temperature Carbonisation

Possible Future Products from Coal

POSSIBLE ways by which the utilisation of coal-tar products might be expanded in the future were discussed by Colonel W. A. Bristow, of Low Temperature Carbonisation, Ltd., at a meeting of the Fuel Luncheon Club held last month in London. He began by saying that since the war started, attention had been concentrated on the possible expansion of coal-tar production and on improving the range of its derivatives. There had been close co-operation between producers, distillers, refiners, distributors and users. A striking advance had been made in the production of fuel oils and other liquid products from coal. The Government had shown great interest in this work and had established the Coal Tar Control, while a number of trade committees had been formed to collaborate with the Coal Tar Controller so that all available resources could be mobilised for the war effort. The trade was now producing a great many tons a year and the country wanted more. The production and distribution of road tars was carried out by a combination of producers in conjunction with the Coal Tar Control, and the business was administered in accordance with a national programme. Although it had been much increased, the quantity of alternative liquid fuels produced from low-temperature carbonisation was only half of what it could be. Great distances were run on these products, his own company alone supplying diesel oil and petrol for 500,000 miles of heavy traffic a week. There was an assured future for these oils and diesel oil made from coal could be produced with any desired cetene number between 50 and 80. He had read a paper by the governor of the Berlin gasworks on oil production by low-temperature carbonisation, which showed that although the German Government was working hard to develop this source of oil they were clearly a long way behind us.

Tar Acids

In this country, too, the producers and the disinfectant manufacturers, at the suggestion of the Control, had put into operation a one-year plan for the supply of high-boiling tar acids for disinfectants, and both producers and manufacturers could now look a year ahead and plan accordingly. Exports to the United States were handled by the new Tar Acids Exports Company, and the American Government in turn had appointed the Defence Supplies Corporation to purchase all the cresylic acid they needed from the United Kingdom. The Controller had arranged the transfer prices with all exporters and the American Government, and this arrangement might well be the prelude to post-war international arrangements of an extremely beneficial character.

In addition to the main products, Colonel Bristow mentioned the new products which have been evolved to take the place of bitumen. Many hundreds of tons of the pale and dark resinous bases developed for the paint industry had been supplied for camouflage and other purposes.

Low-Temperature Gas

Attention had been given to the better utilisation of low-temperature gas which contained up to 97 per cent. by weight of methane, ethylene, and ethane. Curiously enough the low-temperature gas resembled cracked petroleum gas, except that the latter contained more of the C_3 and C_4 compounds, and it had therefore become possible to make from coal a number of valuable materials which America made from petroleum. Ethylene, for example, could be converted into ethylene chlorhydrin, ethyl alcohol, or ethyl benzene, from which such important products as acetaldehyde and styrene could be obtained for use in the manufacture of Buna rubber, tetraethyl lead, acrylic acid resins, polystyrene, and transparent resins such as Perspex. Compressed or in liquid form these gases could also be used as motor fuel; on the continent, for instance, a large number of buses and lorries were now running on C_2 and C_3 fuels. The gaseous and liquid products of low-temperature carbonisation were no longer regarded as merely useful fuels, and the successful development of these possibilities might confer untold benefit on the coal industry.

After this outline of the present position, Colonel Bristow gave his ideas of what he would do if he were responsible for fuel policy after the war. Firstly, he said, he would set up a council to advise the Government on all matters affecting coal, carbonisation, and the production of oil from coal, and this body, he conceived, would include representatives of all those responsible for running the coal and coke industries as well as delegates from the important allied industries, which deal with the derivatives of coal and their development and utilisation. There should be a similar body to advise the Government on all petroleum matters. This council should be free from any outside control or interference. Its reports and recommendations should be made public, although these could not be binding on the Government which must always be ultimately responsible. The basis of any pro-

gramme must be the better utilisation of coal, and the speaker said he hoped we were not going to be so foolish as to continue burning bituminous coal merely as a fuel. It would be of primary importance to utilise our resources of coking coal to the best advantage, and its use for purposes other than carbonisation should be controlled. Our resources were certainly not too plentiful and there was already a certain amount of concern. The question of complete gasification was being studied.

Coal-Oil Policy

On the question of our coal-oil policy, Colonel Bristow thought we should ensure, in our post-war programme, that British coal-oils should enjoy priority in use, for it would be of little account to increase carbonisation greatly unless coal-oils enjoyed a freedom of distribution equal to that which had been given to petroleum in the past. He envisaged the transfer of all the machinery of distribution to an independent national company, which would be charged with the distribution of all liquid fuels and be so constituted that indigenous products would not be prejudiced as to price or priority. All possible steps should be taken to preserve the legitimate interests of the great petroleum industry, to which for many years past the country had been indebted for the efficient way in which supplies of first-class petroleum products had been made available at reasonable prices. He believed the petroleum industry realised that we could not wipe out the effects of the past few years and go back to the old days.

He went on to say that he thought it extremely doubtful whether the price of coke could be materially reduced below its present level. It would be the duty of the Government to devise some means of ensuring that coke could be absorbed in ever-increasing quantities at an economic price to the producers. There was enough evidence to justify the belief that an increased revenue could be expected from the liquid derivatives of coal which would help to reduce the price of the residual coke. But even if coke did cost more per ton than it did before the war, the cost might still be much less than it was in the old days of raw coal if more efficient types of apparatus were adopted for domestic warming and cooking. The expansion of the plastics and synthetic rubber industries and the vast range of fine chemical products opened up further opportunities for coal. The building of an export trade in coal products which could offset the reduction in our raw coal exports would be one of the most vital necessities of post-war years.

To achieve these ends the resources of coal research must be carefully allocated. All research items should be given a priority number and these priorities should not be decided solely by the research organisations, but preferably under the direction of the main body responsible for the whole post-war programme for the industry. To give a simple case: research was being concentrated on domestic solid-fuel-burning appliances, but there was no lead as to the type or types of solid fuel to be catered for. He could say without hesitation that this class of apparatus, burning low-temperature semi-coke, had enormous advantages in heat efficiency, ease of control, comfort, and saving of labour. Its thermal efficiency was three times that of the open stove. Would it not be better to utilise carbonised fuels and gas for domestic heating and thereby save the valuable liquid products?

The Future of Hydrogenation

This fundamental question must be given a high degree of priority which should be settled as part of a national plan and not left to be decided piecemeal as a result of the issues of innumerable local battles between the rival interests of coal, coke, gas, electricity, and oil. It should also be asked whether we were to continue the hydrogenation of coal. The country owed a debt of gratitude to I.C.I. for their enterprise in this field, but times were changing, and petrol engines had largely given place to the diesel type for commercial road transport. Diesel oil was made by low-temperature carbonisation at atmospheric pressure and without catalysts or added hydrogen, and would it not be better therefore to treat all creosote if possible by this method and revert to the hydrogenation of coal itself for the production of petrol as was originally planned? Again, should we take steps to develop a synthetic process, such as the Fischer-Tropsch, by which not only oil but many raw materials for the chemical and plastics industry could be derived from coal *via* gas? There was coal in all the chief countries of the British Empire but little oil, and ought we not to try to perfect a process for use in all parts of the Empire? Plants of this character, combined with low-temperature carbonisation plants, were being run on a large scale in Germany.

Colonel Bristow concluded: "After this war the coal-oil industry and the chemical industry based thereon would be afforded the chance for which they have waited for years, but there must be national planning and wholehearted Government support. If these basic requirements are not forthcoming we shall be sunk, and it is up to us to see they are provided. It is our responsibility to demand that they shall be assured and to show clearly to the nation that they are required not only for the safety and benefit of the industry but are vital to the interests of the community as a whole."

American Regional Laboratories

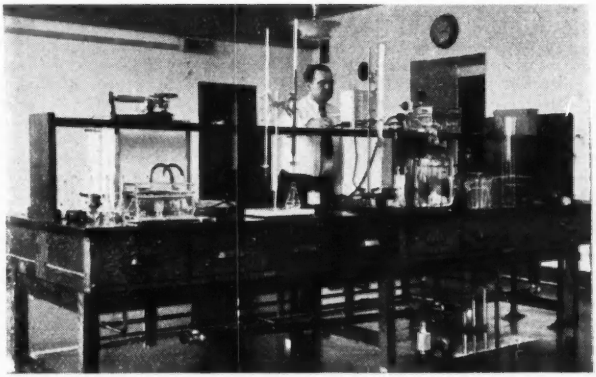
Recent Experiments : Substitute for Fire Hose

TWO years before America entered the war the foundation stones were laid for four regional laboratories intended to assist agriculture in disposing of its produce. What their peace-time work would have been has not been discussed because when the laboratories were ready the United States was engaged in war and the laboratories are now used for other purposes. Much of their work is secret but that which can be published contains many interesting pointers for chemists.

At present some 1000 chemists and their assistants are at work at the Northern, Southern, Eastern, and Western Laboratories, equipped with the latest apparatus, much of it quite original. Recent research work undertaken comprises experiments on lint cotton for making nitrocellulose for smokeless powder, which was usually made from cotton linters, the supply being only sufficient to meet America's own needs. Although final results are not available, it is learned that the laboratories have made good headway and are now experimenting with the Navy Department and industry with a view to industrial production. The principal problem involved in using lint cotton in smokeless powder is cutting it quickly and efficiently to suitable lengths for purification and nitration with existing equipment. A new type of cutting machine is being developed, which, it is hoped will solve the problem.

Cellulose, found in much farm waste, is engaging the attention of one of the laboratories, which is devoting its experiments on cornstalks, corncobs, cotton stalks, sugarcane bagasse, etc. Fire hose is another necessary apparatus which has been under consideration by the laboratories. Usually, the hoses are made of a cotton fabric lined with rubber, or an unlined hose made of linen, but as rubber is scarce and linen is difficult to import, the laboratories are trying to find a substitute. Cotton technologists began working with chemists in an effort to treat cotton, so as to allow the weaving of a fabric to be used as an unlined fire hose, thus replacing the rubber-lined and linen hoses. Again it is impossible to say how far the experiments have gone but it is believed that they are making headway.

Directly concerned with National Defence are experiments for the production of synthetic camphor. This the laboratories have succeeded in drawing from American turpentine, which is rich in pinenes. Naturally, synthetic rubber remains one of the most important fields of experimentation, and isoprene, made from dipentene (from turpentine) is under constant survey. The bureau recently reported experiments with thermal isomerisation derivatives of turpentine, comprising conjugated-chain trienes, which also have potentialities in the synthetic rubber field. These also show interesting possibilities in the drying oil and synthetic resin fields. Other experiments include synthetic tanning materials as well as industrial proteins. The laboratories are destined to play an important part in the war and undoubtedly after the war they will have numerous surprises to offer the chemical and scientific world.



Typical analytical laboratory, Eastern Region.

[Bureau Agric. Chem. and Eng., U.S.D.A.

The Trend of War-Time Earnings—II

Further Accounts Analysed

by S. HOWARD WITHEY, F.C.I.

(*Continued from* THE CHEMICAL AGE, *April* 17, 1943, *page* 424)

DURING the past year, the turnover of International Paint and Compositions Company, Ltd., reached a new high record, and after adding other income the trading profit amounted to £488,682. This figure compares with £428,175 shown in the previous account, and with £398,091 in 1940, but in addition to all working charges, income tax, depreciation, and £3000 for the staff fund, it was necessary to debit the sum of £80,000 as the estimated liability for excess profits tax, consequently the balance of net profit was £10,845 smaller than in 1941, the actual figure being £160,336. The rate of dividend on the ordinary capital has been maintained at 20 per cent., and having regard to the fact that the building up of reserves will enable the directors to draw on funds in the interests of the shareholders should the future hold in store any adverse conditions, the company's general reserve has been increased by £20,000 and £10,000 allocated to the stock reserve, while the development fund receives £3000, and the sum of £8000 is applied in reducing to nil the book value of investments in enemy-occupied countries. The company specialises in the manufacture of anti-corrosive and anti-fouling compositions, paints and varnishes, etc., and has a capital of £734,500, comprising £200,000 in the form of 6 per cent. cumulative preference £1 shares, and £534,500 in ordinary £1 shares. The forward balance has been slightly increased, and a summary of the final appropriation figures for 1942 is given below :—

	£
Brought forward from 1941 ...	21,186
Net profit—1942	160,336
Disposable balance	£181,522
6 per cent. dividend on £200,000 cum. preference £1 shares, gross	12,000
20 per cent. dividend on £534,500 ordinary £1 shares, gross ...	106,900
Transferred to general reserve ...	20,000
Allocated to stock reserve	10,000
Transferred to development fund ...	3000
Investments in enemy-occupied countries, written off	8000
Carried forward to 1943	21,622
	£181,522

The balance sheet shows current assets totalling £1,105,671, giving a surplus of £716,073 over current liabilities, and investments in subsidiaries stand at £377,118. At the recent price of 30s. xd., the preference shares give a return of 4 per cent., and at 110s. xd. the ordinary shares yield over 3.6 per cent.

After providing for taxation, Bradford Dyers' Association, Ltd., was able to report a profit of £388,583, which represents an increase of £12,086 in relation to the 1941 figure, but falls short of the corresponding amount in 1940 by £145,610. Against this must be charged interest on the debenture stock, and depreciation, the latter item being about £10,000 up at £146,309, so that the net profit balance works out at £170,717, after debiting war damage contributions. This figure compares with £166,826 in 1941, and with £269,186 in 1940 when the sum of £60,000 was charged for war damage contributions. The capital of the Association is £4,808,031, consisting of £2,549,237 in the form of preference stock, and £2,258,794 in ordinary stock, and after paying the preference dividend for the 2½ years to December last, the forward balance is raised from £8173 to £19,563, thus :—

	£
Brought forward from 1941 ...	8173
Net profit—1942	170,717
Disposable balance	£178,890
Dividend on preference stock for the 2½ years to December 31, 1942	£318,654
Less income tax at 10s. in the £	£159,327
	159,327
Carried forward to 1943	19,563
	£178,890

The fixed assets and interests in subsidiary and associated companies are shown on the balance sheet at £5,023,445, and the current assets amount to £2,038,938, the floating surplus over current liabilities being £1,083,560 as compared with £1,054,876 at the end of 1941. The ordinary £1 units were recently quoted at 15s., and are likely to appreciate in value with the prospects of the payment of an ordinary dividend.

The audited accounts of Fisons, Ltd., manufacturers of sulphuric acid and fertilisers, and formerly known as Fison, Packard & Prentice, cover the 15 months' operations to the end of September last, during which period the gross earnings amounted to

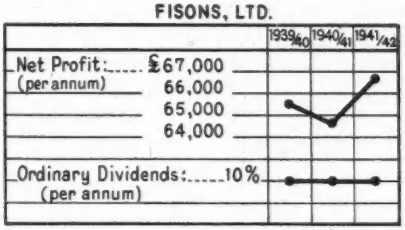
£347,790. This is equivalent to £278,232 per annum, and compares with £244,848 in 1941, and with £237,504 in 1940. After debiting all charges, the balance of net profit for the period is £83,034—equal to £66,427 per annum—which compares with £64,689 shown in the previous account, and with £65,681 realised in 1940. This has enabled the rate of dividend on the ordinary capital of the parent company to be raised from 10 per cent. to 12½ per cent. actual, and the forward balance to be increased from £30,371 to £34,816. The share capital amounts to £1,580,140, consisting of £242,360 in the form of 7 per cent. non-cumulative 1st preference shares—the dividend on which takes £10,603; £500,000 in 5 per cent. cumulative 2nd preference shares—dividend £15,625; and £837,780 in ordinary shares, the final figures being made up as follows:

	£	£
Brought forward from 1940-41 ...		30,371
Net profit—15 months ended September 30, 1942		83,034
Disposable balance		£113,405
7 per cent. dividend on £242,360 1st preference shares for 15 months £21,206		
Less income tax at 10s. in the £ £10,603		10,603
5 per cent. dividend on £500,000 2nd preference shares for 15 months £31,250		
Less income tax at 10s. in the £ £15,625		15,625
12½ per cent. dividend (actual) on £837,780 ordinary shares (equal to 10 per cent. per annum) for 15 months £104,722		
Less income tax at 10s. in the £ £52,361		52,361
Carried forward to 1942-43 ...		34,816
		£113,405

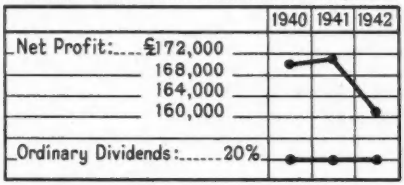
The combined statement of the parent company and its subsidiaries discloses a trading profit of £571,811, and the consolidated balance sheet shows a total of £2,374,283 for fixed assets and interests in subsidiaries. The first preference shares give a return of 5 per cent. at 28s., and at the recent price of 22s. the second preference return more than 4½ per cent. The ordinary shares yield 4½ per cent. at 44s.

Although there was a further expansion of the trading profit of Monsanto Chemicals, Ltd., during the past year, this was largely offset by a higher charge for taxation, and the directors adopted a prudent policy in the distribution of profits in reducing the rate of dividend. Gross earnings plus other income amounted to £557,928, which figure compares favourably with £502,066 in 1941 and with £451,604 in 1940, and with the provision for taxation £50,980 higher at £421,538, the balance of net profit is £75,748. For 1939, a dividend of 33⅓ per cent. was paid on the ordinary shares, but for 1940 the rate was lowered to 23⅓ per cent., the net profit for that year being £105,854, or about £18,000 below the 1939 figure. The dividend for 1941 was again lowered to 16⅔ per cent., the net profit having declined to £67,957, and for 1942 the rate is 8⅓ per

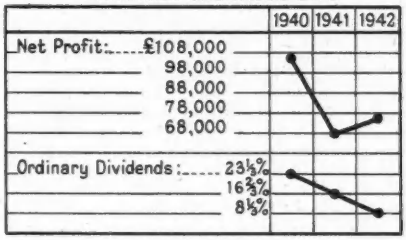
FISONS, LTD.



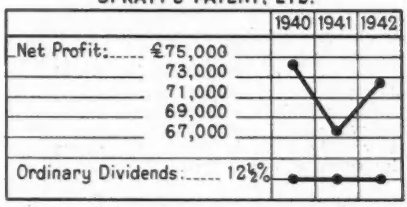
INTERNATIONAL PAINT & COMPOSITIONS CO. LTD.



MONSANTO CHEMICALS LTD.



SPRATT'S PATENT, LTD.



cent., leaving a credit balance of £270,424 to be carried forward to the next account, as against £230,676 brought in. The fixed assets were valued for balance sheet purposes at £791,724, while the current assets amount to £1,307,149.

	£
Brought forward from 1941 ...	230,676
Net profit—1942	75,748
Disposable balance	£306,424
5½ per cent. dividend on £400,000 redeemable cum. pref. shares £22,000	
Less income tax at 10s. in the £ £11,000	11,000
8⅓ per cent. dividend on £300,000 ordinary shares, tax free ...	25,000
Carried forward to 1943	270,424
	£306,424

As compared with the previous year and with 1940, the trading profit made by Spratt's Patent, Ltd., during the twelve months ended December last indicates a slight recovery, the amount working out at £84,685 after debiting taxation. For 1941, the sum of £8000 was allocated to pensions, and £500 to depreciation, after which the balance of net profit was shown at £67,712, as compared with £74,160 in 1940. The 1942 allocation to the depreciation fund is £10,000, the net profit being then returned at £72,185, to which must be added £33,425 brought in from 1941, giving a disposable balance of £105,610. The capital of the company is £650,000, comprising £50,000 in the form of 5 per cent. "A" preference £1 shares; £150,000 in 6 per cent. "B" preference shares; and £450,000 in ordinary £1 shares. For 1939, an ordinary dividend of 15 per cent. was distributed, but the rate was lowered to 12½ per cent. for the following year, and this has since been maintained, the following being the appropriation summary for 1942:—

	£
Brought forward from 1941 ...	33,425
Net profit—1942	72,185
	£105,610
5 per cent. dividend on £50,000 "A" preference shares, gross	2500
6 per cent. dividend on £150,000 "B" preference shares, gross	9000
12½ per cent. dividend on £450,000 ordinary shares, gross	56,250
Carried forward to 1943	37,860
	£105,610

After allowing for the preference dividends, the net earnings are equal to 13½ per cent. of the ordinary capital, consequently the recent price of 55s. is fully justified, and on this basis the actual yield on the ordinary units is more than 4½ per cent. The "A" preference shares are quoted around 23s., and the "B" preference around 24s. 6d.

STATISTICAL VALUATIONS OF SHARES

To enable ordinary shareholders of chemical manufacturing and associated companies to assess the intrinsic values of their holdings apart from extraneous influences, we will reserve space for inquiries from subscribers, whose queries will be answered by Mr. S. Howard Withey, under initials or a pseudonym. When accounts or documents are sent for his perusal, they should be copies only, as they cannot be returned, and no responsibility can be accepted in connection with this service. No valuation can be placed on preference shares, and no advice given regarding the acquisition or disposal of any stocks or shares. Holders of equities wishing to compare the market values of their holdings with the statistical values based on disposable balances should address their inquiries to the Editor.

GRAIN SIZE IN TIN ALLOYS

Interesting light on the part played by grain size in the properties of pure tin and tin-rich alloys is given in the Tin Research Research Institute's publication No. 118, a reprint of a paper by Dr. W. T. Pell-Walpole in *J. Inst. Metals*. His investigations show that variations in tensile strength are controlled by the number of grains in the cross-section, and not by the absolute grain size. In rolled material, an increase in tensile strength is observed as the number of grains in the cross-section increases from 1 to 20 or 30. Elongations are constant over this range. A further reduction in grain size produces only a slight increase in tensile strength, but elongations increase rapidly. The discontinuity in the relationship between tensile strength and grain size is shown to be caused by the corresponding discontinuity in the extension/grain size curve, the latter having some fundamental cause. The calculated true stress was found to vary continuously with grain size. With chill-cast specimens, consisting entirely of columnar grains, tensile strengths increase continuously with reduction of grain size, and elongations are either constant or increase only slightly.

Nearly 2000 varieties of plants containing latex have been tested by research workers at Cornell University using a new rapid test which takes only five minutes to indicate approximate rubber and resin content.

New B.S.I. Specifications

Flow Measurement

THE British Standards Institution has now published a Code for Flow Measurement (No. 1042-1943) which has engaged the work of a Committee since 1938. While full account has been taken of the standards of other countries, the code represents current British practice. Conditions governing the design, installation and use of standard pressure-difference devices are fully set out in order to obtain consistent and generally acceptable results within a specified tolerance from commercial instruments. The "secondary devices" or flow meters are not dealt with, since if all the relevant rules of the code are followed the slight additional tolerance required for any individual flow meter under any given conditions can easily be established by a manometric check. Nor are methods of volumetric measurement of fluid flow by weirs and notches included, as these are covered in B.S. 599 and it is intended to incorporate sections dealing with these methods in the first revision of the code. Copies may be obtained from the B.S.I., 28 Victoria Street, S.W.1, price 12s. 6d.

Copper Rings and Strips

An additional specification (STA/13) in the series of the Services Non-Ferrous Metal Schedule has also just been published. It provides for the quality of material to be used for copper rings and strip for driving bands of all projectiles and shot. The chemical composition of the material is specified and is similar to that covered by B.S. Nos. 1036, 1037, 1038, and 1039, except that bismuth must not exceed 0.005 per cent. Details of the manufacture of the rings are also specified, together with the mechanical properties of the rings, and include hardness, bend, and tensile tests. The specification is published as a single sheet for insertion in a folder issued as B.S./STA/7, and copies are obtainable from the B.S.I., price 6d. each, or 3d. each for 12 or more.

Rhodesian Minerals

A New Production Record

THE mineral output of Southern Rhodesia for 1942 is expected to constitute a new record. The year's aggregate production should be about £330,000 above that of the previous peak year of 1940. This is entirely due to the marked advance in the output of base minerals, since the gold output is 33,000 oz. less than that registered in 1941. The *South African Mining and Engineering Journal* reports that there is a minor boom in base metal prospecting and pegging, an outstanding feature being the quest for tungsten, the production of which is being much encouraged and actually subsidised by loans from the Government.

The Government has also recently taken drastic powers to compel the working of claims carrying strategic minerals. This follows the line of policy indicated in the last annual report of the Department of Mines, in which it was stated: "The present war situation, and particularly developments in the Far East, have so increased the importance of strategic mineral deposits in the Empire that it may well be that the production of strategic minerals in this country will be of more importance to the war effort than the production of gold, so far as the Imperial war effort is concerned. The production of strategic base minerals, therefore, is likely to expand, and every encouragement must be given towards the industry's efforts in this direction.

LETTER TO THE EDITOR

Barytes Production

SIR,—I am anxious to correct an impression which, I understand, has been formed in certain quarters as a result of a statement which appeared in my article in your issue of February 13. When I stated at that time that "one known domestic minefield alone could be made to provide a tonnage of 50,000 to 100,000 tons a year provided the owners were willing," I certainly did not wish to convey the impression that the owners were *deliberately* holding up the development of barytes in this country; in fact, I am well satisfied that British barytes producers are really eager to increase the tonnage of home-produced material.

My contention is, however, that—for the present at any rate—they are not going the right way about it, and that if, as I have already indicated in my articles, they were prepared to make use of the up-to-date methods of processing that are available, and to apply the much greater skill needful on the mining side, a tonnage such as I have described would be procurable. As supplies will require to be drawn from several mines in a given approved area, it is essential that all must come under the control of the same mining engineer so that the mining side may be correctly co-ordinated with the requirements for treatment.

I am aware that there are difficulties; it is rarely a simple matter to change from old-established methods to new ones. But I am not prepared to subscribe to the opinion that the difficulties involved in this instance are insuperable; and in this case the reward—self-sufficiency in barytes is surely worth a little trouble.—Yours faithfully,

W. H. REYNOLDS.

Uttoxeter, Staffs.
May 1, 1943.

Ministry of Supply Chemists

Salaries in Chemical Inspection Departments

DETAILS of the qualifications required and the salary scales for the various classes of Chemical Inspection Department staff of the Ministry of Supply were given in Parliament by Mr. Sandys, in reply to a question from Mr. Linstead. He said that the rates, which are tabulated below, are basic, Civil Service bonus being paid in addition to salaries not exceeding £519 11s. The qualifications shown indicate the general standard required, but particularly useful experience may be regarded in certain instances as equivalent to academic qualifications. Assistants Grades II and III (and the corresponding grades of the Experimental Assistants) are eligible for payment for overtime. Assistants Grade I and Experimental Assistants Grade I receive a modified form of payment for overtime.

Grade	Scale of Pay	Range of pay applicable to war-time entrants*	Normal qualifications
Assistant, Grade III			
Male	£130 × 12—£310	£130—£300	At least Intermediate B.Sc. or equivalent.
Female	£130 × 12—£250	£130—£250	
Assistant, Grade II			
Male	£315 × 12—£385	£315—£350	As for Assistant Grade III with useful practical experience in addition.
Female	£265 × 12—£315	£265—£300	
Assistant, Grade I			
Male	£400 × 18—£515†	£400—£450	As for Assistant Grade II.
Female	£325 × 12—£349 × 18—£415†	£325—£365	
Chemist			
Male	£275 × 18—£455 × 25—£580‡	— —	1st or 2nd Class Honours degree or equivalent.
Female	£275 × 12—£347 × 18—£464‡	—	
Experimental Officer			
Male	—	£275—£550	As for Chemist.
Female	—	£275—£440	

* War time entrants to the Assistant grades are designated Experimental Assistants. Rates on the range are assessed in individual cases according to qualifications, experience, etc.

† With extensions in special cases by annual increments of £18 to £590 for males and to £465 for females.

‡ With extensions in special cases by annual increments of £25 to £680 for males and to £580 for females.

Rosin Acid Products

Dehydroabietic Acid

IF rosin or rosin acids are heated at 150°-250° C. with an active hydrogenation catalyst such as nickel or palladium, the product has a greatly decreased unsaturation and often a higher melting point and improved properties. This treatment has been described in U.S.P. 2,154,877. It was later observed that the products consist of a mixture of at least two types of chemical compound, and that the major constituent, identified as dehydroabietic acid (m.p. 160°-161° C.), can be separated from the mixture by crystallisation from a solution in a solvent such as acetone.

Derivatives of this acid, involving substitutions in the carboxyl group, have been prepared and are described in U.S.P. 2,201,237, assigned to Hercules Powder Co. by E. R. Littmann. These derivatives have a number of useful applications. Esters, for example, may be used as resins or plasticisers in coating compositions; they are said to have much greater resistance to oxidation than the corresponding abietic acid or rosin esters, and their melting points are generally higher. Manganese, cobalt, and zinc salts of dehydroabietic acid are recommended as driers or thixotropic agents; they are very soluble in organic solvents and oils, and because of their stability to atmospheric oxygen they remain in solution indefinitely. The acid halides and primary alcohols derived from dehydroabietic acid are useful in the synthesis of other derivatives, the amides as dye intermediates or as rubber chemicals, while the ethers also find use in coating compositions.—*Paint Tech.*, 1942, *7*, 84, p. 213.

Personal Notes

DR. C. H. MATHEWSON, professor of metallurgy at Yale University, has been elected president of the American Institute of Mining and Metallurgical Engineers.

MR. T. W. GREENWELL, managing director of the Wear Arc Welding Company, is to be nominated as official conservative candidate in the Hartlepool by-election.

DR. J. H. HAMENCE was elected to the committee of the Agriculture Group of the Society of Chemical Industry at its annual meeting on Tuesday. The other officers remained unchanged.

At the meeting of the members of the Royal Institution on May 1, the following officers were re-elected: president, LORD EUSTACE PERCY; treasurer, SIR ROBERT ROBERTSON; secretary, MAJOR CHARLES E. S. PHILLIPS.

SIR JOHN DUNCANSON and MR. EARL A. EMERSON, members of the Anglo-American Mission charged with preparing a survey of the steel situation in Australia, New Zealand, South Africa, and India, have arrived in Australia.

MR. HUGH DUNCAN BUTCHART, who has for many years been a director of Scottish Industries, Ltd. (I.C.I. Scottish subsidiary), has now been appointed chairman of the company, following the death of Mr. J. C. Menzies.

MR. T. E. HOUGHTON, power department manager and group electrical engineer of the general chemical group of Imperial Chemical Industries, Ltd., has been elected chairman of the Mersey and North Wales (Liverpool) centre of the Institution of Electrical Engineers.

DR. CHARLES S. HANES, Ph.D., F.R.S., has been appointed Director of Food Investigation in the Department of Scientific and Industrial Research. Dr. Hanes is at present serving with the Food Mission in North America, his services having been made available by the D.S.I.R. to the Ministry of Food for this purpose.

PROFESSOR ALBERT CHARLES CHIBNALL, F.R.S., Ph.D. (Lond.), Sc.D. (Cantab.), F.I.C., head of the biochemistry department of Imperial College of Science and Technology, has been chosen to succeed SIR FREDERICK GOWLAND HOPKINS in the Sir William Dunn professorship of biochemistry at Cambridge. Aged 49, he will take up his new appointment on October 1. He has been on the staff of London University since 1924, when he became hon. assistant in biochemistry at University College. In 1930 he was appointed Assistant Professor at Imperial College, and succeeded to the Chair in that subject in 1936. In 1923-24, he held a research fellowship at Yale, and again visited that university in 1928, as a lecturer. He was elected an F.R.S. in 1937, and is a past secretary of the Biochemical Society.

The Chemical Society has elected PROFESSORS LINUS PAULING, NIKOLAI SEMENÓV, and NIKOLAI ZELINSKY as honorary fellows. Professor Pauling, aged 42, has been for 15 years professor of chemistry at the California Institute of Technology, and director of the chemical laboratories there since 1937. He has carried out extensive research into the nature of chemical bond by means of wave mechanics, X-ray study of crystals, electron diffraction of vapours, and in other ways. His work has contributed much to modern views of chemical structure. Professor Zelinsky is the veteran Russian organic chemist whose reputation is world-wide. Head of one of the largest chemical schools in Russia, his original contributions have been numerous and of the highest quality. Professor Semenov is also internationally famous. He has been director of the Institute of Chemical Physics at Leningrad since it was opened in 1931. Trained as a physicist, he was led to the study of chemical reactions through his work on the breakdown of insulators under electric discharges. In many ways his work brought problems of combustion, ignition, and explosion within range of simple quantitative treatment for the first time.

Obituary

MR. JOSEPH MAY COON, who has died at St. Austell, aged 87, had specialised for 56 years in the geological study of china clay. His researches and studies in this direction had enabled china clay to receive both scientific and legal status as a mineral.

New Control Orders

Textile Bags

The main object of the Control of Textile Bags (No. 1) Order (S. R. & O. 1943, No. 616), issued by the Ministry of Supply, is to subject the use and disposal and acquisition of used cotton bags measuring 16 in. by 28 in. or larger to the same restrictions as jute bags. The Order replaces the Control of Jute Bags (No. 1) Order which was designed to ensure that the best possible use is made of jute bags in the country to save the shipping space required to bring new supplies from India. There are also additions to the list of goods that may be delivered in used textile bags; and provision is made for certain other special uses. Special attention is drawn to the " Care and Preservation " clause of the Order, and to the obligations under the Order upon users and recognised collectors, dealers and repairers to furnish returns every three months to the Jute Control, 1 Victoria Road, Dundee.

General News

From Week to Week

Among new members of the Manchester Chamber of Commerce, elected during April, are the Lancashire Chemical Works, Ltd., High Street West, Glossop.

The 1943 edition of the Medical Manual of Chemical Warfare has been issued by the War Office at the price of 2s. 6d. (2s. 8d. post free).

Timber, fit only for manufacture of charcoal, fuel or conversion into firewood blocks, is freed from control by licence and its maximum price is fixed at 25s. a cord.

The provision of technical education for girls as well as for boys was advocated by Miss I. Haswell, speaking at the annual conference of the National Union of Teachers in London last week.

In order to keep lime works in full production during the summer, the lime subsidy is increased from 50 to 60 per cent. for deliveries to occupiers of agricultural land between May 1 and August 31.

A summary of the duties imposed by the Magnesium (Grinding of Castings and Other Articles) Order has now been printed in the shape of a small poster (Factory Form 1010), and is published by H.M. Stationery Office at the price of 2d.

A surprise development has taken place in the seaweed industry in Scotland. Large numbers of workers engaged in this highly-paid industry in the West of Scotland have received notices terminating their employment as from May 4. Several hundred workers affected by this development will be absorbed in other branches of industry.

Sir Percy Harris, chief Liberal whip, told the Manchester Liberal Federation on Saturday that this country possessed the best scientists and engineers in the world and they must have scope for their abilities. "We must not again make the mistake of starting research too late in the peace. There must be a different spirit in industry. To get the best out of industry there must be a pooling of ideas and a sharing of profits," he added.

The Ministry of Food has made an Order, which comes into force on May 17, prohibiting the labelling of any soap substitute for sale by retail except under licence. No label should be regarded as having been approved unless it bears the words "Soap Substitutes, Licence No. . . ." The object of the Order is to limit the production of soap substitutes, and to prevent the sale of many worthless substitutes now being offered to the public. It does not apply to the sale of such substances as washing soda, ammonia, or benzine, sold under their ordinary trade names and descriptions.

At the eleventh annual meeting of the Plastics Group of the Society of Chemical Industry next Tuesday, resolutions are being tabled by Mr. H. V. Potter to the effect that a subscription of 2s. 6d. should be instituted, and that a hospitality officer should be appointed to be responsible for the social side of all meetings of the Group.

The British Standards Institution, in the first of a series of booklets on "Office Aid to the Factory," claims that a production control department in all war factories will result in the avoidance of bottlenecks, delays in delivery, and idle time. The booklets will deal in detail with organisation to increase war production and save man-power.

A proposal has been mooted to form a Scottish section of the Institute of the Plastics industry. A preliminary meeting was held in the Royal Technical College, Glasgow, on May 2, to discuss the formation of the section. An address on "Some General Aspects of the Plastics Industry," was given by the chairman of the Institute, Mr. T. L. Birrell.

The Board of Trade has published a correction affecting the General Licence dealing with petroleum products (*see* THE CHEMICAL AGE, May 1, p. 487). The second sentence of the paragraph should read: "Hairdressers who made toilet preparations before October 1, 1941, and are not registered in Part I of the Toilet Preparations Register may now make up for use only small quantities of liquid petroleum products which were purchased before January 1, 1943."

The value of scientific knowledge in agricultural practice has not been recognised by farmers, according to the Luxmoore Report on Agricultural Education. The National Farmers' Union, however, emphatically refutes this allegation, and say the fault lies in the manner in which scientific advice has been presented in the past. They add that farming demonstrations now being held to stimulate crop production are well attended, showing how willing farmers are to recognise the value of scientific knowledge presented to them in a practical way.

Foreign News

Liquid nitrogen has found a new use in America. General Electric are using it to shrink steel parts used in making war-time electric apparatus. To fit a metal rod into a cylinder of equal diameter, for instance, the rod is dipped in liquid nitrogen to shrink it, and is then fitted in position. The rod quickly expands to its original diameter and forms a strong bond with the cylinder.

Inclusion of the scrap metal industry among those considered essential to the war effort has been announced by the War Manpower Commission of the U.S.A.

Materials which are critically short in America include zinc, chromium, methyl methacrylate, benzene and its derivatives, and methyl alcohol, states the War Production Board in its seventh "critical list."

Toluol from petroleum provides explosives for two-thirds of the bombs used by America's fighting forces, while nearly all of the toluol derived from gasworks goes into T.N.T. production.

Twenty-two research fellowships in chemistry for 1943-44 are announced by Du Pont de Nemours and Co. Women as well as men are eligible, although previously only male chemists were considered.

Ciba, the Swiss chemical company, is again paying a dividend of 17 per cent. from the net profit of 7.67 (8.20) million francs, remaining after 3.87 (4.27) million francs have been set aside for depreciation.

A new Bulgarian company, entitled "Maritsa," has been formed with a capital of 150 million leva, and proposes to manufacture copper sulphate, sulphuric acid, oleum and fertilisers.

Standard presses for plastics are now being produced in Germany in three sizes for operation by hand, and in four sizes for operation by motor. A licence is required for manufacture of the presses.

Potato tops for cellulose manufacture are now being regularly purchased in Germany at a price of 3 RM per 100 kg., to which a bonus may be added for packing and delivery free factory.

The 1941 report of Süddeutsche Holzverzuckerungswerke A.G. has now been published. Yeast production was started in May of that year, and saccharose production a little later. Work on some departments still continues. The net profit of 4.27 million RM was used for certain special depreciation needs.

The Hungarian Bauxite Mines Company has raised its capital from 16.80 to 18.48 million pengö. This is the fifth increase in a comparatively short time, and further increases are expected, as about 25 million pengö are to be invested in the plant planned in 1940 and under construction since.

A synthetic fluid is being used by the Germans when they are shorrt of real blood for blood transfusions. This statement was made to pressmen by the Brigadier commanding a British blood transfusion depot. He said that a good deal of the synthetic substitute had been captured in Libya but when brought to England and tried on laboratory animals the results were not good.

Present Canadian plans for synthetic rubber production do not include the use of industrial alcohol, according to a Parliamentary reply given by the Hon. C. D. Howe, Minister of Munitions and Supply.

Simplified production of tanks and motorised transport has saved 5,000,000 lb. of nickel, 3,500,000 lb. of chrome, and over 1,000,000 lb. of molybdenum, according to Mr. W. L. Batt, vice-chairman of the U.S. War Production Board.

Synthetic rubber for Canada may only be imported by the Government-owned company, Fairmont Co., Ltd. A new order of the Department of Munitions states that this company is the only agency which may deal in synthetic Buna-S rubber and synthetic butyl rubber before processing.

Two German producers of tar distilling plant, Gesellschaft für Teerverwertung G.m.b.H. (Meiderich) and Heinrich Koppers G.m.b.H. (Essen), have formed a syndicate for the construction of continuous coal-tar distilling plant. The construction work will be in the hands of Heinrich Koppers.

America's "Central Register"—the National Roster of Scientific and Specialised Personnel—has catalogued details of about 500,000 scientists and professional men, and over 140,000 names have been certified to agencies engaged in the war effort, reports the National Resources Planning Board.

The synthetic rubber plant near Sarnia, Ontario, will eventually produce 41,00 tons a year—34,000 tons of Buna-S type and 7000 tons of butyl rubber. The buildings are almost finished, but installation of equipment for processes entirely new to the Canadian industrial field remains to be completed.

Chemical works suffered particularly in the R.A.F. raid on Stettin on April 20, it is reported. Two edible-oil works—the P. J. Stahlberg (8 acres) and the A. H. Zander factories (6 acres)—were almost totally ruined; the industrial catalyst factory of the Didier Werke A.G., which covered 14½ acres, was completely burned out; and another chemical factory, covering 51 acres, had all but one of its buildings damaged, including 90 wholly destroyed.

T.V.A. triple superphosphate has received a considerable amount of publicity in Britain recently. *Chem. and Met. Eng.* (February, 1943) reveals, however, that relatively little production of triple superphosphate is carried out at electric furnace plants, all of which (including the plant of T.V.A.) are concentrating on the manufacture of phosphorus and phosphoric acid. T.V.A. produced a small amount of "triple super" which has been exported principally to Britain through Lend-Lease channels.

Forthcoming Events

The London section of the **Society of Chemical Industry** will meet jointly with the **Institute of Metals** at the Junior Institution of Engineers, Victoria Street, S.W.1, at 6 p.m. on **May 10,** when Mr. E. A. G. Liddiard will speak on "Modern Methods of Metallurgical Analysis."

Dr. Wilson Baker will speak to the Leeds area section of the **Chemical Society** on "Some Consequences of Hydrogen Bond Formation" at the University, Leeds, at 5.30 p.m., on **May 11.**

The **Royal Photographic Society,** scientific and technical group, will hear Dr. G. Spiegler speak on "Contrast and Definition on X-Ray Pictures," at 5 p.m., on **May 11,** at 16 Prince's Gate, S.W.7.

Following the annual general meeting on **May 11,** the **Plastics Group** of the Society of Chemical Industry will hold a joint meeting with the **Institute of the Plastics Industry** and the **Institution of Structural Engineers,** at the Windsor Castle Hotel, Vauxhall Bridge Road, S.W.1. It will start at 7.30 p.m., and will take the form of a miniature symposium on "The Practical Uses of Plastics in Building and Structural Work." Two papers, followed by general discussion, will be read by Mr. F. S. Snow and Dr. A. Caress.

Dr. E. M. Delf will speak to the **Royal Society of Arts** on "The Nature and Uses of Seaweeds" at 1.45 p.m. on **May 12.**

At a meeting of the colour group of the **Physical Society,** at 2.30 p.m., on **May 12,** at the Lighting Service Bureau of the E.L.M.A., Savoy Hill, W.C.2, Mr. G. S. Fawcett will give a lecture entitled "Sixty Years of Colorimetry."

The annual general meeting of the South Yorkshire section of the **Institute of Chemistry** will take place on **May 12,** and will include a discussion on the education and training of the chemist, opened by Dr. G. Lawton and Mr. W. F. Andrews. It will be held at 198 West Street, Sheffield.

The annual general meeting of the **Iron and Steel Institute** will take place at 4 Grosvenor Gardens, S.W.1, at 2.45 p.m. on **May 12.** The transaction of official business will be followed by the presentation and discussion of the first report of the Marine Corrosion Sub-Committee, and a review of "Basic Open-Hearth Practice at an Australian Plant."

Dr. H. J. Emeléus will speak on "Modern Technique in Inorganic Chemistry," at a meeting of the **Chemical Society,** at Western Bank, Sheffield, at 5.30 p.m., on **May 14.**

Two lectures on "Some New Properties of Inorganic Dusts" will be presented by Professor H. V. A. Briscoe to the **Royal Society of Arts,** on **May 17** and **24,** at 1.45 p.m. They will be illustrated by lantern slides.

The London section of the **Electrodepositors' Technical Society** will meet in the Northampton Polytechnic, Clerkenwell, E.C.1, at 5.30 p.m., on **May 17,** when a paper on "Possibilities of Electro-Deposition from Non-Aqueous Solutions" will be presented by the president, Dr. H. J. T. Ellingham.

A paper summing up the series on "Agriculture To-day and Tomorrow" will be presented by Sir John Russell to the **Royal Society of Arts,** at 1.45 p.m., on **May 19.**

The **Chemical Engineering Group,** Society of Chemical Industry, will hold the annual general meeting and luncheon at 12.30 p.m., on **May 19,** in the Waldorf Hotel, Aldwych.

The **Institute of Chemistry,** London and South-Eastern section, will meet at 30 Russell Square, W.C.1, on **May 19,** at 6 p.m., when Dr. J. W. Cuthbertson will give a lecture on "Recent Advances in the Electro-Metallurgical Industry."

The thirty-third annual May lecture of the **Institute of Metals** will be delivered by Professor G. P. Thomson, D.Sc., F.R.S., at 6 p.m., on **May 19.** The lecture, entitled "Electron Diffraction," will be given in the hall of the Institution of Mechanical Engineers, Storey's Gate, S.W.1.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Receivership

ASBESTOS MOLYBDENUM AND TUNGSTEN CO., LTD. (R., 8/5/43.) E. F. Jones, 17 St. Helens Place, Bishopsgate, E.C., appointed receiver on April 7 (in place of D. H. Allan, deceased).

Company News

William Briggs and Sons, Ltd., announce an interim dividend of 5 per cent. (same).

An interim dividend of 5 per cent. (same) is announced by **British Benzol and Coal Distillation, Ltd.**

Greeff Chemicals Holdings, Ltd., announce a final dividend of 5 per cent., plus a bonus of 2 per cent., making 10 per cent. for the year (same).

The Association of Glue and Gelatine Buyers, Ltd., have changed their name to the Association of Glue and Gelatine Distributors, Ltd.

A profit for 1942 of £362,199 (£308,187) is announced by the **British Oxygen Co., Ltd.** The dividend is increased from 14 to 15 per cent.

The British Match Corporation is paying a final dividend of 5½ per cent., making 8 per cent. for 1942 (same). The net profit was £336,777 (£340,881).

The United Molasses Co., Ltd., announce a second interim dividend of 12½ per cent., making 20 per cent. (same), and a cash distribution of 2½ per cent. (same). No further distribution will be recommended for 1942.

British Celanese is to convert the whole of its 5½ per cent. mortgage debenture stock into 4 per cent. first mortgage debenture stock. The old stock is being redeemed at £105 per cent. and the new 4 per cent. stock is being issued at £101 per cent.

New Companies Registered

J. Brierley, Son and Gray, Ltd. (380,185). —Private company. Capital: £500 in 500 shares of £1 each. Copper smiths and smelters, copper sulphate manufacturers, tube makers, brass, bronze and alloy manufacturers, engineers, etc. Directors: D. A. Gray; Annie Gray. Registered office: Renbold Works, Renbold Place, Royal Hill, S.E.10.

Brenchley and Partners, Ltd. (380,163). —Private company. Capital: £500 in 500 shares of £1 each. Research workers, consultants and advisers, laboratory and workshop proprietors, manufacturing and analytical chemists, manufacturers of and dealers in lubricating oils, grease, wax, fats, etc. Subscribers: A. Heigh; Edith Hammond. Secretary: G. C. Wood, 4 Kirkgate Buildings, Huddersfield.

Chemical and Allied Stocks and Shares

LESS active and slightly reactionary conditions have ruled in the stock and share markets, where sentiment was influenced by the break between the Russian and Polish Governments and also by the disposition to await the next war developments. In accordance with the general tendency, shares of chemical and kindred companies maintained a steady undertone, and where prices were lower, declines have been very moderate.

Imperial Chemical at 38s. 9d. were unchanged on balance, it being realised that the yield is not unattractive, and the prevailing market view is that the dividend will, in all probability, remain on an 8 per cent. basis during the period of the war. Borax Consolidated at 34s. 6d. again provided a steady feature, but elsewhere General Refractories eased slightly to 15s. 10½d., sentiment having been influenced by the chairman's cautious remarks regarding the outlook for the current year. On the other hand, rather more attention was given to Dunlop Rubber, awaiting the financial results; compared with a week ago, the price has improved from 34s. 6d. to 35s. 6d. at the time of writing. Moreover, British Oxygen were better at 78s., as were British Aluminium at 50s. 3d. Elsewhere, British Plaster Board moved higher to 29s. At 23s. 7½d. Triplex Glass were better on balance, and United Glass Bottle held their recent rise to 62s. 6d. The yield on the latter is small based on the 12 per cent. dividend which has ruled for some time; nevertheless, this has been conservative, and last year over 20 per cent. was earned on the ordinary shares.

At 76s. 9d. Turner & Newall more than held their recent improvement, while in other directions Allied Ironfounders continued in request, pending the dividend announcement, and have moved higher to 48s. 9d. at the time of writing. Tube Investments were firm and maintained at 94s., but Stewarts & Lloyds eased to 52s. xd. Guest Keen gained a few pence to 34s. 3d., while Dorman Long were 26s., compared with 24s. 9d. a week ago. Awaiting the financial results, Babcock & Wilcox were little changed at 51s. 6d. There was further improvement to 14s. 6d. in Imperial Smelting shares, but in other directions Lever & Unilever eased to 35s. In response to the maintenance of the dividend, which was in accordance with general expectations, British Match were firm at 38s. 9d. xd. At 41s. 9d. Barry & Staines were unchanged on balance, and Nairn & Greenwich at 66s. 3d. were also the same as a week ago, as were Wall Paper Manufacturers deferred units at 37s. Business at 8s. 6d. was recorded in William Blythe 3s. shares, British Glues & Chemicals 4s. ordinary were maintained at 7s., while at one time Burt Boulton transferred at 19s. 4½d. As usual, B. Laporte remained very firmly held, and were again quoted at 78s. "middle." Lawes Chemical 10s. shares transferred at 12s. at one time. Greeff-Chemicals Holdings 5s. ordinary have again changed hands around 8s.

Among plastics, British Industrial Plastics 2s. shares kept at 5s. 10½d., Lacrinoid Products were 4s. 6d., and Erinoid 11s. 6d. Dealings up to 25s. 3d. have been shown in British Xylonite 5 per cent. preference shares. There was again some activity in Goodlass Wall 10s. ordinary, which, in front of the forthcoming dividend announcement, having moved higher to 14s. Among other securities, British Emulsifiers 2s. ordinary continued to change hands around 3s. 4½d. Steadiness at 41s. 6d. has again been shown in Boots Drug at the time of writing. Moreover, awaiting the dividend announcement, British Drug Houses were again quoted at 22s. Sangers, however, eased to 21s. 1½d. At 17s. 3d. Amalgamated Metal shares were 3d. better on balance. Earlier small gains were not held by leading oil shares.

British Chemical Prices

Market Reports

BUSINESS in the market for heavy chemicals during the past week has been on steady lines, the chief movement of supplies being against existing contracts which cover good volumes. In the soda products section the call for deliveries of industrial refined nitrate of soda keep up at a good level, while a fair trade has been passing in soda ash and bicarbonate of soda. Both Glauber salt and salt cake are being called for steadily against contracts. In the potash section a well sold position is reported for permanganate of potash and caustic potash, with acid phosphate of potash in good request. Yellow prussiate of potash continues scarce and values are largely nominal. In the market for coal-tar products a steady call for supplies in most sections has been mainly against contracts, and only a few new transactions have been reported. The benzols and toluols are active and there has been fresh inquiry for the xylols.

MANCHESTER.—Trading conditions on the Manchester chemical market during the past week, more especially with regard to the contract movement of supplies, have been pretty well back to normal after the holiday slackness and a steady flow of delivery specifications in the soda products, as well as in the acids and the ammonia and magnesia compounds, has been reported, while a moderate volume of new business has been transacted, fresh orders covering a fairly wide range of materials. Price conditions are very firm throughout the market. Among the by-products, sellers are more concerned with reducing current commitments than in adding to them.

GLASGOW.—In the Scottish heavy chemical trade there was a slight improvement during the past week for home business. Export trade is still rather restricted. Prices remain firm with no actual changes to report.

Following the success of small-scale experimental planting, a consignment of seed of the *kok-saghyz*, the rubber-producing dandelion, has reached Australia from Russia, having travelled *via* the Persian Gulf and Bombay.

Traces of mercury, described as "very promising," have been discovered in the Kalpitiya district, on the northern part of Ceylon's west coast, according to Reuter. First investigations point to rich sub-surface deposits, and borings are to be made. This is the first time that signs of mercury have been discovered in Ceylon.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in this paper should not be taken as an indication that they are necessarily available for export.

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Vertical Steam Jacketed MILD STEEL MIXER or SOAP PLODDER, by E. Forshaw & Son; pan 4 ft. 0 in. dia. by 2 ft. 6 in. deep, fitted with vertical agitating gear; two sets of mixing blades, mounted on horizontal shafts and driven through bevel gearing; mixing blades revolve in opposite direction and are driven from vertical shaft by bevel gearing from f. & l. pulleys.

Vertical Steam Jacketed Copper MIXER, by Brierley, Collier & Hartley; pan, 1 ft. 9 in. dia. by 1 ft. 4 in. deep, with jacket suitable for a working pressure of 100 lbs. per sq. in.; overdriven agitating gear of the bowl and scraper type, fitted with power operated rise and fall mechanism; final drive through machine cut gears from f. & l. pulleys.

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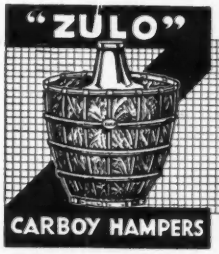

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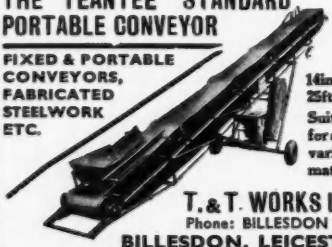

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